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DISCOVERIES AND IMPROVEMENTS IN ARTS, MANUFACTURES,
AND AGRICULTURE.

Observations by M. Biot, on a new kind of Spectacles, invented by Dr. Wollaston.

EVERY one knows that those whose eyes are too convex cannot see distant objects distinctly, because the pencils of rays of light intersect each other in the eye before they reach the retina. On the contrary, those whose eyes have too little convexity, as is generally the case in old persons, can not see with distinctness those objects that are at a short distance, because the rays converge to a point that is beyond the retina. The former defect is remedied by the use of concave glasses, which remove the focus of rays to a greater distance; the latter is relieved by convex glasses, which have the effect of shortening the focus.

But those who have recourse to common spectacles cannot see with distinctness any objects which are not nearly in the direction of the axes of the glasses. Objects seen remote from the centres are distorted and confused, by reason of the obliquity of the rays to the surfaces of the glass, which occasions a degree of irregular aberration. Hence, with such glasses, the view can embrace but a small number of objects at a time. The head must be moved in such a manner as to direct the axes of the glasses to each object in succession, with great inconvenience in very many instances.

It is now some years since Dr. Wollaston proposed a remedy for this defect by a very simple invention. He remarked that since the pupil of the eye is of a very small size, it is in fact but a very small portion of a spectacle-glass that is employed in any one position of the eye, though its several parts are used in succession when any lateral motion is given to the eye. He thence inferred that the form usually given to such glasses, though well adapted to other uses, for which the rays from all parts of the glass are to be collected into one focus, is not the best for spectacles; but that the best construction would be that which would give to all parts separately the same power of assisting the sight, when the eye is turned to each of them in succession. Dr. Wollaston was thus led to the obvious conclusion, that the form should be (*bombée*) convex without and

concave within, so that rays coming to the eye would pass nearly at right angles to the surface of the glass in all directions. These glasses were called by the inventor Periscopic, and the exclusive sale of them was secured to Messrs. Dollond by patent.

My attention having been some time since drawn to this subject by an article in Nicholson's Journal, I proposed a trial of them to my friend M. Cauchois, well known as a skilful optician in general, and more particularly by the large achromatic lenses which he has lately made of flint-glass manufactured in France by M. Dartigues. I requested his opinion on the subject; for, though our theory should direct the artist, his assistance and experience are necessary to confirm our results. M. Cauchois very soon made several pairs of periscopic spectacles of different focal lengths, for the purpose of trying their merits. For though Dr. Wollaston had given no measures for the different curvatures of the surfaces, M. Cauchois, who is conversant with the theory as well as with the practice of his art, had no difficulty in discovering such combinations of curvature as would answer his purpose. In those which he made first, the surface most curved was nearly concentric with the eye. The pupil might then be turned to the full extent of the glass on each side, and see *nearly* as well as through the centre. The field of view gained by this construction is really surprising, and it would require a person to be for some time trained to the use of the common defective glasses, to be fully sensible of all the superiority of these. For my own part, I have not been accustomed to wear spectacles commonly, and have only used them occasionally for seeing distant objects; but for the last three months I have regularly used the periscopic glasses, and I certainly never shall employ any others.

There was, indeed, one inconvenience in those first constructed by M. Cauchois, which would be felt by those who are in the habit of wearing spectacles constantly. In looking towards a candle, particularly in a theatre where there are ma-

ny lights, there appeared a variety of reflected images beside the principal object viewed, which occasioned some confusion. This arose from a combination of reflections between the two surfaces, which, in consequence of the degree of difference of their curvatures, occasioned a distinct image to be formed on the retina after two reflections. M. Cauchoix has, however, happily succeeded in removing this inconvenience altogether, by making the inner surface of the glasses less concave than he did at first, so that whatever light may enter the eye after reflection is no longer brought to a focus, and consequently is not perceived. We have then a larger field of view than with common spectacles, without introducing any new inconvenience.

During the last three months M. Cauchoix has made trial of these spectacles on a great number of persons, and even upon one so short-sighted that he could not see beyond two inches and a quarter, which is certainly a case of extreme short-sightedness. All these persons agree in making the same favourable report. The trials made by elderly persons requiring the assistance of convex glasses have also been attended with just the same success.

I am the more particular in noticing these trials of some months continuance, because it is by continued trial alone that we can be certain of the goodness of spectacles, and in general of optical instruments that do not magnify much. The eye has a certain flexibility, and power to accommodate itself for a short time to a glass that does not quite suit it. But if the same degree of effort is to be long continued, the eye tires, and complains of an imperfection that was not at first perceptible.

It appeared to me that so decided an improvement upon an instrument generally used, and indeed so necessary to many persons, deserved some public notice; and I advise those who ever use spectacles to make trial of these. If they are as well satisfied as I have reason to expect, they will derive a further gratification from reflecting that the science which thus adds to our enjoyment of the objects immediately around us, is the same that has made us acquainted with the remotest

parts of our solar system, and given us some conception of the extent of the Universe.

(Signed) BIOT.
Member of the Imperial Institute.

Hints respecting the proper mode of inuring tender plants to our climate; by the Hon. Sir Joseph Banks, Bart. K.B. P.R.S., &c.

(From the Transactions of the Horticultural Society of London.)

Respectable and useful as every branch of the horticultural art certainly is, no one is more interesting to the public, or more likely to prove advantageous to those who may be so fortunate as to succeed in it, than that of inuring plants, natives of warmer climates, to bear without covering, the ungenial springs, the chilly summers, and the rigorous winters, by which, especially for some years past, we have been perpetually visited.

Many attempts have been made in this line, and several valuable shrubs, that used to be kept in our stoves, are now to be seen in the open garden; there is, however, some reason to believe, that every one of these was originally the native of a cold climate, though introduced to us through the medium of a warm one; as the gold tree, *Aucuba japonica*, the mountain, *Paeonia frutescens*, and several others have been in our times.

In the case of annuals, however, it is probable, that much has been done by our ancestors, and something by the present generation; but it must be remembered, that all that is required in the case of an annual, is to enable it to ripen its fruit in a comparatively cold summer, after which, we know that the hardest frost has no power to injure the seed, though exposed in the open air to its severest influence; but a perennial has to encounter frosts with its buds and annual shoots, that have been sometimes so severe with us, as to rend asunder the trunks of our indigenous forest trees.*

It is probable, that wheat, our principal food at present, did not bring its seed to perfection in this climate, till hardened to it by repeated sowings; a few years ago, some spring wheat from Guzerat was sown with barley, in a well cultivated

† As they have been made from the first by Messrs. Dollond.

* See Miller's Dictionary, article Frost.